LITTORAL COMBAT/POWER PROJECTION FNC
EXLOG GROUP
SHIPBOARD INTERNAL CARGO MOVEMENT PROGRAM

OBJECTIVE :

- Cargo strike up&down of 6,000 lb (min) or 12,000 lb (objective) in sea state 5
- Cargo rates of 414 pallets/hr
- Workload reduction up to 75%
- Selective offload
- Material available for issue within 4 hours
- Reductions in weight and power consumption
- Improved stowage densities and packaging

PAYOFF:

- Potential Reduced Manning
- Increased Aircraft Sortie Rate
- Reduced CONREP Time
- Reduced Time Off-station for Combat Ships

APPROACH:

- Awards in multiple technology interest areas made Spring 02.
- Initial Downselect early FY03.
- Approximately $24M investment over 5years

TECHNOLOGY INTEREST AREAS:

- Load Movement and Handling
- Cargo Stowage
- Selected Offload

SCHEDULE:

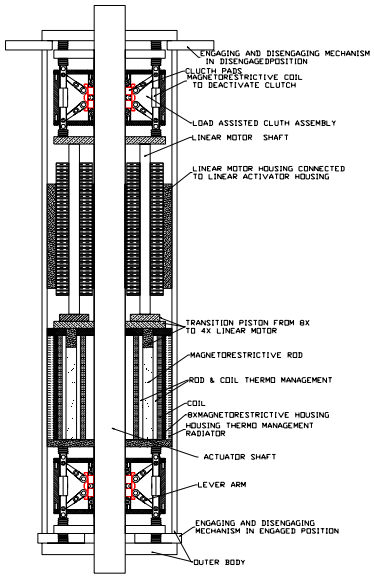
TASKS	FY01	FY02	FY03	FY04	FY05	FY06
Initial BAA And Downselect	△—△					
Initial Technology Development		△—△				
Downselect			△			
Technology Maturation			△——	——△		
Technology Integration And Transition				△————	———	———△

TRANSITION TARGETS:

- PEO EXW
- PEO CARRIERS
- DDX

Hybrid Linear Actuator

Prototype Linear Thruster



Proposed Actuator

DESCRIPTION: An actuator that would combine a set of magnetostrictive thrusters with either a tubular linear induction motor or a linear synchronous motor that could replace hydraulic cylinders or electric motors in cargo handling gear. A clutch/brake mechanism as part of the actuator would be developed.

ENABLING S&T:

- High Power Density Magnetostrictive Actuators
- Advanced High Precision Fabrication Methods
- Advanced Permanent Magnets

BENEFITS:

- Potential for weight, space and power savings.
- Potential to improve many cargo handling systems by replacing hydraulic or electric motors.
- Reduced maintenance, particularly specialized (fluid system) repair personnel.
- Supports electric ship initiatives.

Products:

- Breadboard Demonstration Unit
- Specification Package
- Component Drawing Plan
- Component Design Verified by Testing
- Space/Weight/Power Reservation Data

TEAM:

- NAVSEA Philadelphia, Code 977
  - PI: Dave Brady
- NSWC-CARDEROCK Materials Science Branch
- Temple University
- Global/SFC Valve Integrated Manufacturing
- CSC Advanced Marine

Hybrid Linear Actuator - 2

DRAFT Exit Criteria

Criteria	Current Capability	Minimum	Goal
TOC	High Life-Cycle cost of Actuators.	Reduce TOC by 25%. TRL 4	Reduce TOC by 75%.
Power Reduction	Actuator power within ships needs.	Reduce power consumption by 10%. TRL 5	Reduce power consumption by 25%.
Power Density	Actuator power density within ships needs.	Improve power density by 20%. TRL 5	Improve power density by 50%.

TEST STRATEGY:

- Simulations of subsystems and interactions will be conducted during the Base Period.
  - Time domain and frequency domain for interactions.
  - FEA for structures and magnetic flux.
  - Dynamics simulation for thermal, magnetic, frequency and dynamic model response.
- Tests will be conducted during the Option Period to determine actual structural, magnetic and mechanical parameters of the actuators.

SCHEDULE:

TASKS	FY02	FY03	FY04
Evaluation of Alternatives			
Detail Design			
Fabrication			
Testing			

Linear Electric Drive Transport Technology

Concept Arrangement

Demo Model

DESCRIPTION: A horizontal/vertical cargo movement system powered by Linear Induction Motor (LIM) technology. This is an extension of a previous SBIR. Technology development includes a prime mover, breaking and control system for the conveyor. The system allows automatic transition between horizontal and vertical movements.

ENABLING S&T:

- Linear Induction Motors Providing Levitation and Motive Force
- Electrodynamic braking mechanisms

BENEFITS:

- Reduced Workload due to robotics and system controls.
- Improved integration ability since vertical movement trunks do not need to be perfectly vertical and follow hull contours.
- Increased throughput speed resulting from ability to handle larger loads.

Products:

- Technology Demonstrator Unit
- Specification Package
- Component Design Verified by Testing
- Risk/Integration/CAIV Analyses
- Space/Weight/Power Reservation Data

TEAM:

- General Dynamics Armament Systems
  - PI: Doug Hartwell
- Power Superconductor Applications Corp.
- Unidynamics, Inc.
- NAVSEA Philadelphia, Code 977
- CSC Advanced Marine

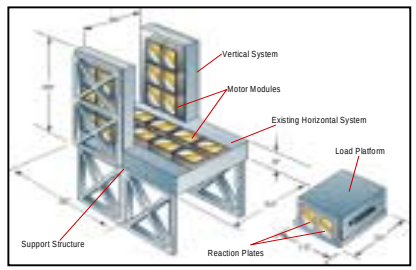
Linear Electric Drive Transport Technology - 2

DRAFT Exit Criteria

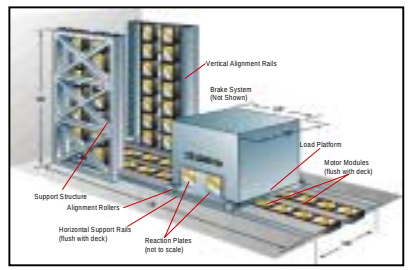
Criteria	Current Capability	Minimum	Goal
Increased Handling System Capacity	Manhandling, 4,000 lb forklifts	Handle Naval packaging up to 6,000 lbs TRL[2] 5	Handle Naval packaging up to 12,000 lbs
Increased Handling System Speed	Various, many ships require manhandling.	Improve elevator shaft utilization by 2. TRL 6	Improve elevator shaft utilization by 5.
Handling System Operating Condition	No consistent operating condition definition.	Operate at rated load with 15° heel/maintain load control with a 30° heel. TRL 6	Same
Workload Reduction	Current workload is supported by ship crew.	No increase in workload over current elevators. TRL 4	Workload reduction of 30% over current systems.
Weight Reduction	Weight of existing systems within ships needs.	Weight gain within 5%. TRL 5	Weight Reduction of 20%.
Power Reduction	Existing systems supported by ship power.	Power gain within 5%. TRL 5	Reduce Power Consumption by 20%.

TEST STRATEGY:

- Base Period
  - LEDT technology is currently at TRL 4.
  - Vertical and horizontal components will be integrated to demonstrate a 1,000 lb load handling capacity.
  - The technology will mature to TRL 5.
- Option Period
  - Advance the technology to TRL 6.
  - A 12,000 lb capacity system with a longer range of travel will be tested on a simulated ship motion environment. .



Base Period

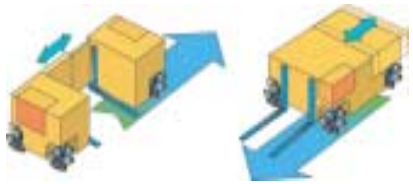


Option Period

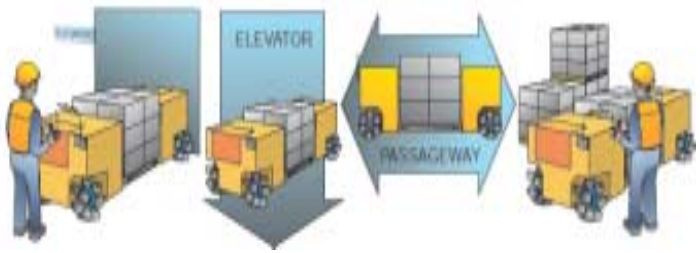
SCHEDULE:

TASKS	FY02	FY03	FY04
Initial Development			
Scale Testing			
Further Development			
Full Capacity TD Testing			

Omni Directional Vehicle Technology



Notional ODV Configurations



Operational Concept

DESCRIPTION: An omni-directional vehicle married to a forklift type operation. The vehicle is capable of motion in any direction and could rotate within its own footprint. It will have an intelligent control and navigation system that allows it to autonomously travel between deck stations and a hold.

ENABLING S&T:

- Omni-directional Wheel Technologies
- Intelligent Automated Vehicle Guidance Systems with Obstacle Negotiation and Avoidance

BENEFITS:

- Reduced Workload due to robotics and system controls allowing autonomous navigation.
- Omni-Directional motion has less arrangement impact than forklifts by eliminating turning areas.
- Potential for reduced maintenance over forklift trucks.
- Will carry larger loads than forklifts but have a smaller footprint.

Products:

- Technology Demonstrator Breadboard
- Specification Package
- Design Definition Package
- Component Design Verified by Testing
- Risk/Integration/CAIV Analyses
- Space/Weight/Power Reservation Data

TEAM:

- General Dynamics Armament Systems
  - PI: Doug Hartwell
- Airtrax, Inc.
- Lockheed Martin Naval Electronics and Surveillance Systems – Surface Systems
- NAVSEA Philadelphia, Code 977
- CSC Advanced Marine

Omni Directional Vehicle Technology - 2

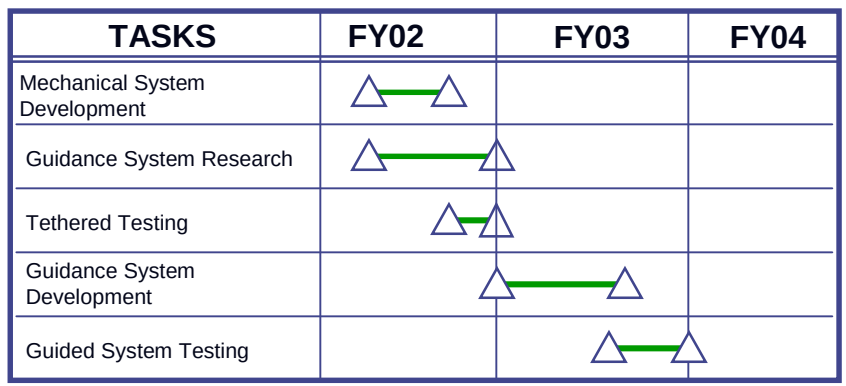
DRAFT Exit Criteria

Criteria	Current Capability	Minimum	Goal
Increased Handling System Capacity	Man Handling/ 4,000 lb forklift.	Handle Naval packaging up to 6,000 lbs TRL 6	Handle Naval packaging up to 12,000 lbs
Increased Handling System Speed	Various, many ships require man handling.	Throughput of 414 pallets in 6 hours. TRL 5	Throughput of 414 pallets/ 100 QUADCON in 6 hours (not concurrently).
Handling System Operating Condition	No consistent operating condition definition.	Operate with 15° heel/ maintain load control with 30° heel. TRL 6	Same
Workload Reduction	Manpower intensive.	Reduction of 10%. TRL 4	Reduction of 50%.
Power Reduction	Existing systems supported by ship power.	Reduce Power Consumption by 25%. TRL 6	Reduce Power Consumption by 50%.
Weight/ Volume Reduction	Weight/ Volume within ships needs.	Reduce Weight/ Volume 25%. TRL 5	Reduce Weight / Volume 50%.

TEST STRATEGY:

- Base Period
  - Refurbish existing unpowered ODV chassis.
  - Demonstration of the powered ODV with remote manual inputs.
  - The results of the tests will be part of the basis of the end of year downselect.
- Option Period
  - A remotely controlled ODV system will be built. The ODV and control system will be demonstrated.
  - At completion, the gap between the demo performance and requirements identified resulting in a decision on how far the prototype ODV is from being deployable to the fleet.

SCHEDULE:

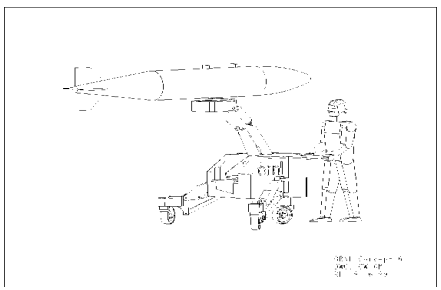


Human-Amplification Technology (HAT) for Shipboard Cargo Handling and Transport

HAT

Single Person Lifting

5,000 lb



Concept Sketch

DESCRIPTION: A family of highly steerable vehicles with HAT handling devices of differing capacities. The system compensates for ship motions in the HAT mode and allows the operator to only "feel" the load. The primary vehicles have a weapons/cargo handling arm and are push-pull propelled.

ENABLING S&T

- Human Amplification Technology
- Off-Centered Omni-Wheel Technology
- Ship Motion Compensation for Force Control-Based Systems

BENEFITS:

- Reduced Workload due to Robotics/Weapons handling ability.
- Increased aircraft sortie rates.
- Highly steerable motion has less arrangement impact than forklifts by eliminating turning areas.
- Potential for reduced maintenance over forklift trucks.

Products:

- Technology Demonstrator Unit
- Specification/Requirements Package
- Ship Motion Compensation Algorithms
- Component/Controls Design Verified by Testing

TEAM:

- Oak Ridge National Laboratory
  - PI: Dr. François Pin
- Newport News Shipbuilding
- CSC Advanced Marine

Human-Amplification Technology (HAT) for Shipboard Cargo Handling and Transport - 2

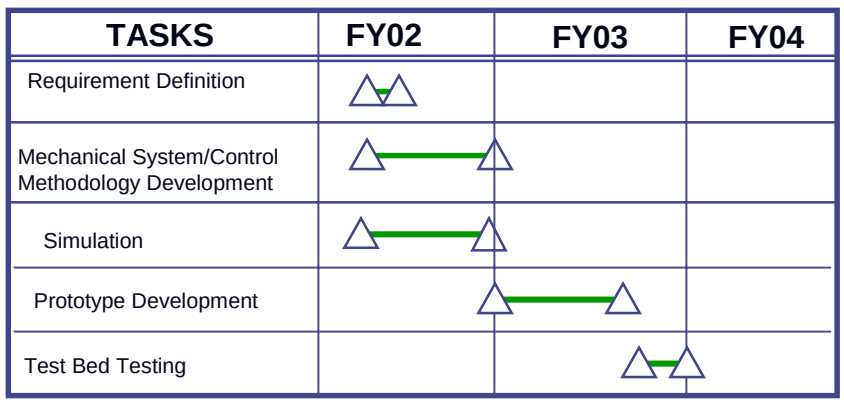
DRAFT Exit Criteria

Criteria	Current Capability	Minimum	Goal
Increased Handling System Capacity	Manhandling. 4,000 lb forklifts.	Handle Naval packaging and weapons up to 6,000 lbs TRL 6	Handle Naval packaging and weapons up to 12,000 lbs
Increased Handling System Speed	Various, many ships require manhandling.	Improve Sortie Rate by xx%. TRL 4	Improve Sortie Rate to 200 strike sorties per day.
Handling System Operating Conditions	No consistent operating condition definition.	Operate continuously with 15° heel, maintain load control with 30° heel. TRL 5	Same
Workload Reduction	Manpower intensive.	Support reduction of 25% . TRL 5	Support reduction of 75%.
Deck Pressure	Decks are rated for xxx	Deck pressure shall be limited to (deck pressure for primary decks). TRL 5	Deck pressure shall be limited to (deck pressure for secondary decks).
Obstacle Avoidance	Human visibility.	Human visibility. TRL 5	Obstacle avoidance for autonomous operations.

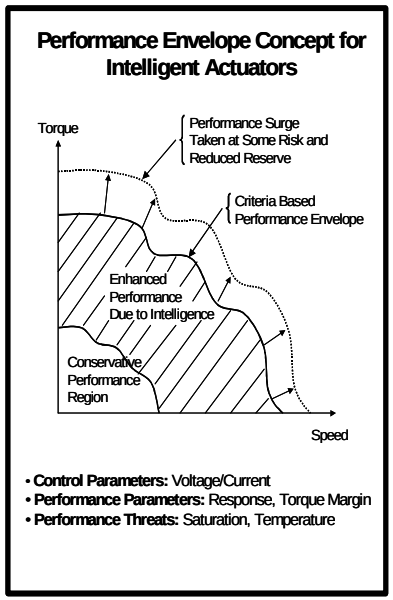
TEST STRATEGY:

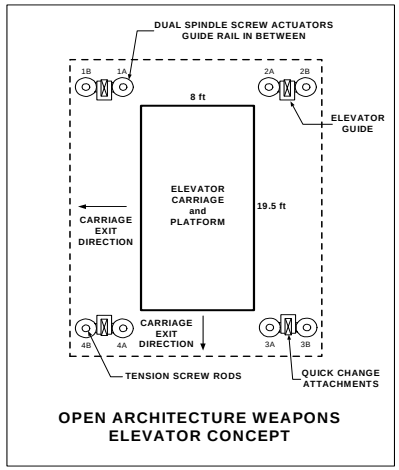
- Initial Simulations will be conducted on individual components.
- Overall simulation model at end of Base Period to allow end of period downselect.
- Individual components tested, integrated into subsystems and tested as a system.
- Testing of integrated components on ship motion simulator using corresponding ship motion force compensation paradigms.

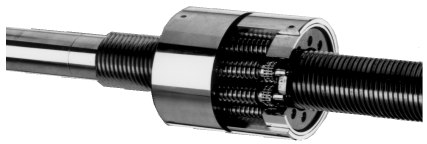
SCHEDULE:



Advanced Weapons Elevator







DESCRIPTION: A new weapons elevator and ballistic elevator shaft cargo hatch for aircraft carrier-type weapons elevators that would improve weapons handling rates with reduced maintenance and enhanced utilization flexibility. The primary technology is a spindle screw actuator with condition based maintenance built in. The system includes a new, faster ballistic hatch and a highly dexterous mobile elevator carriage.

ENABLING S&T:

- Advanced Actuator Drive Systems
- Intelligent Mechanical Systems

BENEFITS:

- Increased aircraft sortie rates.
- Improve elevator shaft utilization by a factor of 5.
- Enhanced utilization flexibility.
- Potential for increased reliability and reduced maintenance.

Products:

- Tabletop Model or Simulation
- Specification Package
- Component Design Verified by Testing or Analysis
- Space/Weight/Power Reservation Data

TEAM:

- Newport News Shipbuilding
  - PI: Scott Cummings
- Virginia Consortium for Material Handling & Logistics
  - Old Dominion University
  - University of Virginia
  - Virginia Polytechnic Institute
- CSC Advanced Marine

Advanced Weapons Elevator - 2

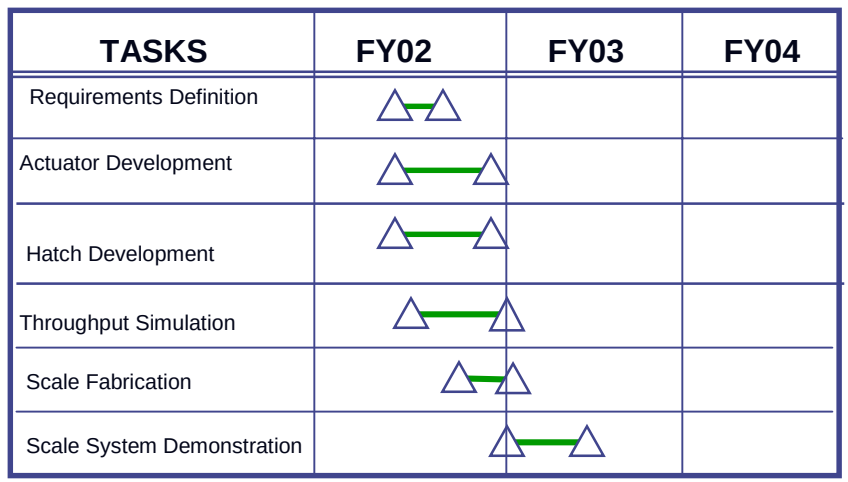
DRAFT Exit Criteria

Criteria	Current Capability	Minimum	Goal
Increased Handling System Speed	Various, many ships require man-handling.	Improve elevator shaft utilization by 2. TRL 6	Improve elevator shaft utilization by 5.
Handling System Operating Condition	No consistent operating condition definition.	Operate with 15° heel and maintain load with 30° heel. TRL 6	Same.
Workload Reduction	Current workload is supported by ship crew.	No increase in workload over current elevators. TRL 4	Reduction of 30% over current elevators.
Weight Reduction	Weight of existing systems within ship needs.	No weight gain over system being replaced. TRL 5	Weight Reduction of 20% vs current elevator.
Power Reduction	Existing systems supported by ship power.	No power gain over the system being replaced. TRL 5	Reduce Power Consumption by of 20%.
Reliability	Current elevators have reliability concerns.	Partial redundancy with “limp home” feature. TRL 5	A 100% redundant system.

TEST STRATEGY:

- Extensive testing of actuators to determine reference performance map to allow performance optimization and actuator intelligence development.
- Computer modeling, primarily at component level, as proof of concept prior Base Period downselect.
- Tabletop model of the ballistic hatch.
- Quarter scale model of entire system.
- Eventual full scale testing after transition as part of the R&D effort.

SCHEDULE:



Sensor-Based Dynamic Manipulation in Unpredicted Motion

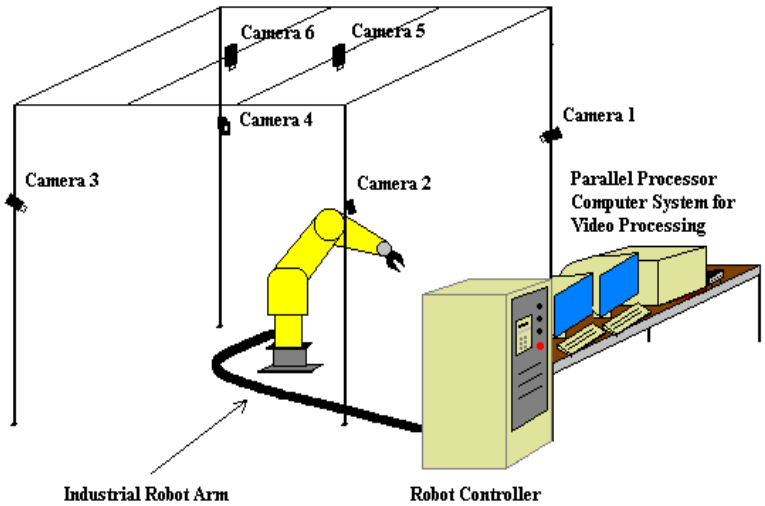


Diagram of Test Setup

DESCRIPTION: Control system for robotic arm manipulation that integrates continuous visual sensing with robotic manipulation, this allows the arm to grab and manipulate the randomly moving object. Technology includes continuous multi-viewpoint shadow sensing visual technology and dynamic robotic grasp and manipulation algorithms.

ENABLING S&T:

- Robotics
- Continuous Sensing and Tracking using Image Differencing
- Integration of Real-Time Sensor Networks and Dynamic Robot Manipulations Algorithms

BENEFITS:

- Ability to grasp and manipulate loads moving at random in a seaway such as at the end of a crane hoist wire or CONREP trolley wire.
- Potential benefit to commercial industry.

Products:

- Control Algorithms Verified by Testing or Analysis
- Draft Space/Weight/Power Reservation Data
- Integration Study

TEAM:

- Clemson University
  - PI: DR. Adam Hoover/Dr. Ian Walker
- CSC Advanced Marine

Sensor-Based Dynamic Manipulation in Unpredicted Motion - 2

DRAFT Exit Criteria

Criteria	Current Capability	Minimum	Goal
Increased Handling System Capacity	Manhandling. 4,000 lb forklifts.	Handle Naval packaging and weapons up to 6,000 lbs TRL 5	Handle Naval packaging and weapons up to 12,000 lbs
Dynamic Handling	Manhandling.	Grasp and manipulate objects moving in Sea State 5. TRL 4	Same.
Handling System Operating Condition	No consistent operating condition definition.	Operate continuously with 15° heel, maintain load control with 30° heel. TRL 4	Same
Workload Reduction	Manpower intensive.	Support reduction of 25% . TRL 4	Support reduction of 75%.

TEST STRATEGY:

- Demonstration in laboratory robotic cell of the ability of a robot to automatically track, grasp and manipulate a randomly moving, less than rigid object.

Robotic Cell

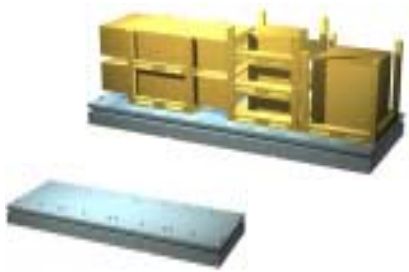
SCHEDULE:

TASKS	FY02	FY03	FY04
Identify Mechanical System Teaming partners			
Hardware Development			
Sensor Network and Manipulation Algorithms			
Laboratory Demonstration			

Universal Loading Tray

ULT in: 20' Container/
CONREP Trolley/ ODV

Loading/Unloading Trays



Loading Tray

DESCRIPTION: A standard load handling platform for cargo and weapons movement based on the removable elevator base platform proposed in the NAVSTORS system. The platform has standard self-locking devices within its top surface and handling self-locking devices at the corners. The platform will be compatible with standard 20' ISO Containers, CONREP trolleys and other advanced cargo handling gear.

ENABLING S&T:

- High Strength Composites
- Robotic Tooling Interfaces

BENEFITS:

- A universal handling platform is required for dramatic improvement in cargo handling.
- Interface with other automated handling systems.
- Enables seamless handoff of cargo loads between different components of cargo system without need for additional handling or staging.

Products:

- Breadboard ULT and CONREP Trolley
- Specification Package with Design and Manufacturing Guidance
- Component Design Verified by Testing
- Weight/Cost Data
- Performance Simulation

TEAM:

- NAVSEA Philadelphia Code 977
  - PI: Tom McCammon
- Agile Systems, Inc.
- Robotics Research Corporation
- General Tool Company
- M. Rosenblatt & Son Group of AMSEC LLC
- NSWC-IH Detachment PHS&T Center
- CSC Advanced Marine

Universal Loading Tray - 2

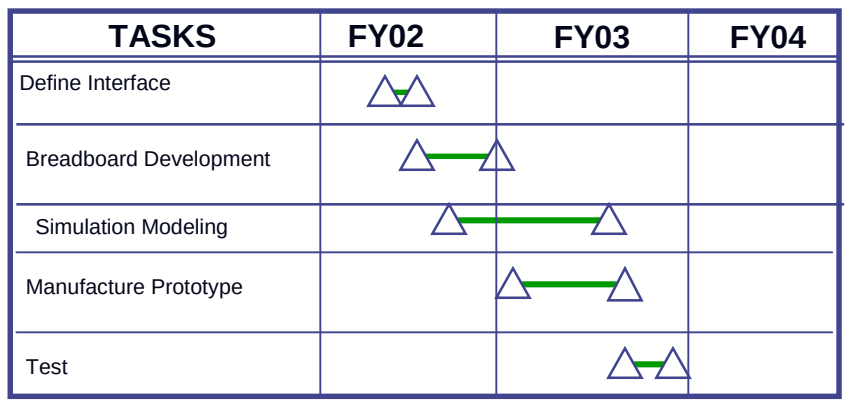
DRAFT Exit Criteria

Criteria	Current Capability	Minimum	Goal
Increased Handling System Capacity	Man Handling/ 4,000 lb.	Handle Naval packaging up to 6,000 lbs TRL 6	Handle Naval packaging up to 12,000 lbs
Increased Handling System Speed	Various, many ships require man handling.	Throughput of 414 pallets in 6 hours. TRL 5	Throughput of 414 pallets/100 QUADCON in 6 hours (not concurrently) .
Handling System Operating Condition	No consistent operating condition definition.	Operate with 15° heel/ maintain load control with 30° heel. TRL 6	Same
Workload Reduction	Current systems are manpower intensive.	Reduction of 10%. TRL 4	Reduction of 50%.

TEST STRATEGY:

- Base Period
  - Preliminary simulation models.
- Option Period
  - Finish simulations to evaluate the rates at which other portions of the handling chain must operate to eliminate staging and to optimize throughput.
  - Breadboard systems will be built and tested.
    - Load/Unload ULT from ISO Container.
    - Load/unload from cargo weapons elevator mockup.
    - On land-based UNREP mockup, use ULT and an omni-vehicle to simulate UNREP operations.

SCHEDULE:



NAVSTORS Components

Pallet Carriers

NAVSTORS Concept

Standard Pallet Interface

DESCRIPTION: In support of the NAVSTORS automated magazine, two high risk components - the Standard Payload Interface (SPI) and Robotic Pallet Carriers – will be developed. SPIs provide common grasping interface and automatically secure cargo for transit. Payload Carriers are powered, robotic sleds that automatically move loads around the magazine.

ENABLING S&T:

- High Strength Composites
- Robotic Tooling Interfaces

BENEFITS:

- A Universal Handling Platform is required for dramatic improvement in cargo handling.
- Interface with NAVSTORS automated handling systems.
- Enables Selective Offload of magazines and holds.

Products:

- Breadboard Robotic Carriers, Pallet Interface and Auto-Lock Mechanisms
- Specification Package with Design and Manufacturing Guidance
- Robotics Control Package
- Component Design Verified by Testing
- Weight/Cost Data

TEAM:

- NAVSEA Philadelphia Code 977
  - PI: Tom McCammon
- Agile Systems, Inc.
- Robotics Research Corporation
- General Tool Company
- M. Rosenblatt & Son Group of AMSEC LLC
- NSWC-IH Detachment PHS&T Center
- CSC Advanced Marine

NAVSTORS Components - 2

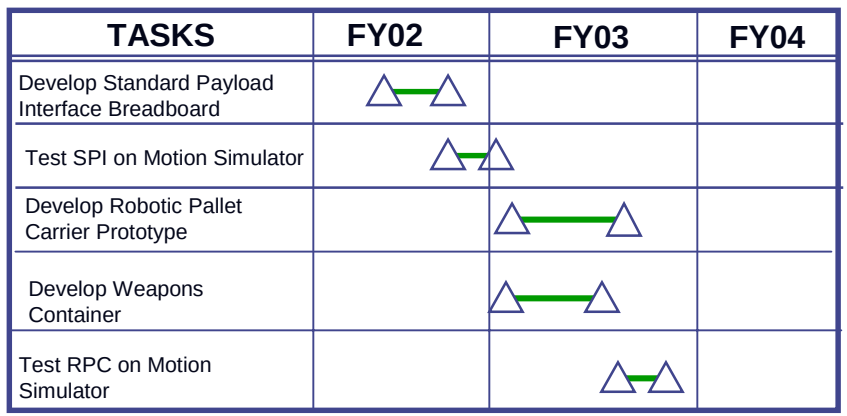
DRAFT Exit Criteria

Criteria	Current Capability	Minimum	Goal
Increased Handling System Capacity	Man handling/ 4,000 lb forklifts.	Handle Naval packaging up to 6,000 lbs TRL 6	Handle Naval packaging up to 12,000 lbs
Selective Offload	None.	Ability to call up any specific package (container, pallet, etc.) for breakout of required load. TRL 6	Ability to call up any specific load.
Handling System Operating Condition	No consistent operating condition definition.	Operate continuously with 15° heel and maintain load control with 30° heel. TRL 6	Same
Workload Reduction	Manpower intensive.	Support reduction of 10%. TRL 4	Support reduction of 50%.

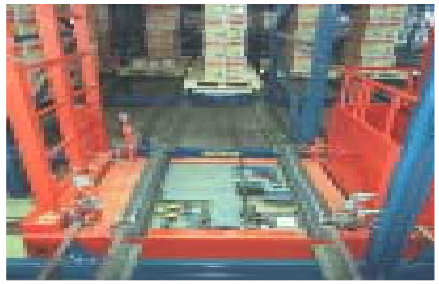
TEST STRATEGY:

- Base Period
  - Develop brassboard Standard Payload Interfaces.
  - Test on Ship Motion Simulator with payloads to sea state 7, monitoring stress and vibration.
- Option Period
  - Develop brassboard Robotic Payload Carriers
  - Test on Ship Motion Simulator with realistic payloads, monitoring stress and vibration.
  - Assess ability of Robotic Payload Carriers to operate in up to sea state 5 and maintain load in up to sea state 7.
  - If successful, assess ability of “smart indexing” to allow limited speed operation in up to sea state 7 with the same drive system.

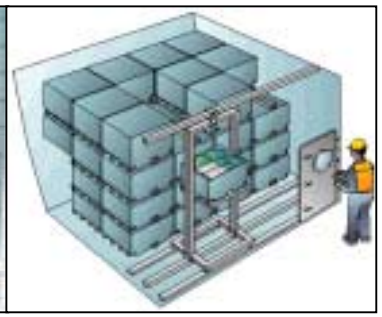
SCHEDULE:



Automated Stowage and Retrieval System



Satellite Assembly Device



DESCRIPTION: Modification of an existing COTS technology Automated Stowage and Retrieval System to marinize the system. The ASRS system would automate storerooms, holds and magazines and would allow for selective offload of pallets or containers. Loads would automatically be locked into stowage during Strike-Down and unlocked for Strike-Up.

ENABLING S&T:

- Automation Controls
- Load Stabilization
- Component Marinization

BENEFITS:

- Reduced Workload due to robotics and system controls.
- Selective offload to the package (nominally pallet) load.
- Increased throughput speed resulting from ability to handle larger loads.

Products:

- Technology Demonstrator Unit
- Specification Package
- Component Design Verified by Testing
- Risk/Integration Analysis
- Space/Weight/Power Reservation Data

TEAM:

- General Dynamics Armament Systems
  - PI: Doug Hartwell
- Siemans Dematic
- NAVSEA Philadelphia, Code 973
- Bath Iron Works
- CSC Advanced Marine

Automated Stowage and Retrieval System - 2

DRAFT Exit Criteria

Criteria	Current Capability	Minimum	Goal
Increase Capacity	Manhandling /4,000 lb forklifts.	Handle up to 6,000 lbs TRL 6	Handle up to 12,000 lbs
Increase Speed	Various.	Throughput of 414 pallets in 6 hours. TRL 5	Throughput of 414 pallets in 6 hours/100 QUADCON in 6 hours.
Handling System Operating Condition	No consistent definition.	Operate with rated load and 15° heel /load control with 30°heel. TRL 6	Same
Reduce Work Load	Manpower intensive.	Reduction of 25%. TRL 4	Reduction of 75%.
Selective Offload	None.	Ability to call up any specific package (container, pallet, etc.) TRL 6	Ability to call up any specific load.

TEST STRATEGY:

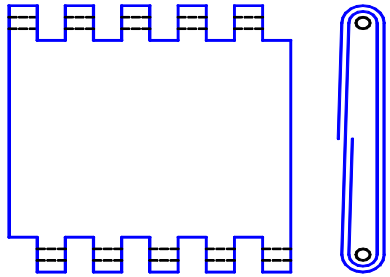
- Modeling and simulation will be performed.
  - Conducted During Base Period.
  - Used to validate the selected concept and to explore optimization of the configuration.
- Technology Demonstrator (TD) will be built for the latter portion of the Option Period.
  - Tested on a ship motion simulator.
  - Full scale demonstrator that will have the load capacity of the objective system.
  - Configured to test all functions present in the objective system but limited number of storage locations to fit on the ship motion simulator.
  - TD will reduce development risk by demonstrating that the shipboard ASRS can maintain positive load control in the dynamic environment of the ship.

SCHEDULE:

TASKS	FY02	FY03	FY04
COTS Demo			
System Architecture Development			
Simulation and Demonstration			
TD Design			
Integration and Test			

Blast Mitigation Technologies to Improve Stowage Density and Reduce Risk Associated with Ordnance Afloat

Test Specimen after Explosive Test



Schematic of Layup

DESCRIPTION: Lightweight composite material and manufacturing processes for new generation ordnance containers that may contain the blast of the weapons they stow.

ENABLING S&T:

- Lightweight Blast-Resistant Structures
- Advanced Manufacturing Techniques

BENEFITS:

- Potential to improve stowage density and flexibility by limiting segregation requirements.
- May permit packaging and stowage of ordnance assembled in “mission ready” configurations.
- Potential for safety advances in Navy ships.

Products:

- Advanced Manufacturing Processes
- Advanced Materials
- Demonstration Units
- Blast Containment Ability Verified by Testing
- Application Analysis
- Weight/Cost Reservation Data

TEAM:

- NSWC-IH Detachment PHS&T Center
  - PI: Robert Dress
- Galaxy Aviation Security, LLC
- CSC Advanced Marine

Blast Mitigation Technologies to Improve Stowage Density and Reduce Risk Associated with Ordnance Afloat - 2

DRAFT Exit Criteria

Criteria	Current Capability	Minimum	Goal
Stowage Conditions	Designed for the specific ship seaway response.	Withstand 45° static roll plus a 0.5 g lateral acceleration. TRL[1] 6	Same
Blast Mitigation	No blast mitigation capability.	Mitigate Net Explosive Weight of M148/M48e1/ T45 Series Adapter Booster for the Mark 80 series LDGP bombs. TRL 6	Mitigate Net Explosive Weight of Maximum Credible Event, to be determined during the program.
Stowage Density	Current stowage density supports ship needs.	Maintain Stow Factor. TRL 4	Improve Stow Factor.
Weight Reduction	Weight of existing systems fits within ships needs.	Reduce Weight by 25% over system being replaced. TRL 5	Reduce Weight by 50% over system being replaced.

TEST STRATEGY:

- Base Period
  - Static tests on panels with different materials/ manufacturing processes.
  - Small lightweight container will be tested with increasing charge weights until their blast containment capacity is bounded.
- Option Period
  - Static tests and nondestructive inspections on panels with different materials/manufacturing processes as identified in Base Period.
  - Test prototype system with target ordnance

SCHEDULE:

TASKS	FY02	FY03	FY04
Develop Material/Process Technologies			
Test Scale Container			
Material Refinements			
Optimizing Manufacturing Methods			
Final Test			
Approval through NOSSA			